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(54) Title: A METHOD AND A DOUGH FOR PRODUCTION OF LAMINATED/SHEETED YEAST-BASED BAKERY PRODUCTS

(57) Abstract

The present invention concerns a method and a dough for production of laminated/sheeted yeast-based bakery products, e.g. Danish pastries, from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, after which the mixed base dough is worked (kneaded), rolled and laminated/sheeted in dough layers separated by layers of fat, and eventually formed and filled with fillings. The pre-dough is prepared from water, yeast, sugar, eventually flour and/or scrap-dough, and additives and fermented, alternatively after resting in a cold store, or after thawing from a frozen condition before mixing into the base-dough, after which the ready dough is baked.

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A METHOD AND A DOUGH FOR PRODUCTION OF LAMINATED/SHEETED YEAST-BASED BAKERY PRODUCTS

TECHNICAL FIELD

The present invention concerns a method and a dough for production of laminated/sheeted yeast-based bakery products, e.g. Danish pastries, from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, after which the mixed base dough is worked (kneaded), rolled and laminated/sheeted in dough layers separated by layers of fat, and eventually formed and filled with fillings.

BACKGROUND ART

The invention is based on a new production process for a base dough containing yeast which is subsequently laminated/sheeted according to the different demands of the respective products to be formed and baked at a later stage. Examples of the different types of dough are:

- Danish pastries.
- Croissant and horn pastries.
- Birke pastries.
- Sweet coffee dough pastries.

All the above types of dough/pastry have the following production and technological aspects in common:

- A base dough containing yeast is mixed.
- To this base dough fat of animal and/or vegetaria origin is added and/or laminated/sheeted to obtain a product with layers of fat and dough in different quantities.
- The end product is formed and shaped according to individual demands.
- The end product is proofed in a proofer where both temperature and moisture is controlled for a period of 15 - 60 minutes.

- The end product is subsequently baked.

The production process has been automated during the past few years whilst at the same time the production of unproofed frozen doughs have more or less replaced the lengthy process described above. There are three production methods used today for these types of products:

-A traditional method, where the products is manufactured every day and baked the same day. (This is the zero quality test for reference). This method is labour intensive and the initial capital investment is not utilised 100 %. This type of production may only take place in approved bakery premises which thus exclude typically bake-off shops. Expensive investment costs in proofers and a large variation in the baking of the end product depending not only on production but even on proofing times and the quality of the proofer.

-A production of frozen, unproofed and unbaked products according to the conventional method, but where the amount of yeast and sugar is increased and dough improvers utilised in order to compensate for the deterioration of the yeast performance that takes place during the freezing process. Before baking the product, it is defrosted, tempered to room temperature, proofed for a 20 % longer time than under the first method and then baked. This method demands expensive capital investment for production and even expensive capital for the end user. Not only does the quality of the end product depend on how the production process is taking place, but even more so depending on the defrosting and proofing process by the end user.

-A production of preproofed products, where the product is manufactured according to the traditional method, proofed to between 50 and 100 % of the end volume and then frozen. Baking of the frozen end product can take place without defrosting. This method demands an even higher capital investment with proofing lines. The manufacturing process is even more costlier due to the

fact that yeast cells are alive and can cause fermentation in any area that has not been cleaned properly including in and on the machines. The end product is larger than the unproofed product which means that transport and storage costs can be as much as double depending on which percentage of proofing is attained.

By the patent publication DE-B2-1 642 566 a method is known for the production of a dough, which can be frozen and baked without being thawed. A pre-dough is prepared and kept resting. After that this pre-dough is mixed with further ingredients and kept resting, after which a forming and a filling is done. After deep-freezing the product can be baked without thawing. However the pre-dough in this case does not contain yeast and the baked product is not of the same kind as the products made from a dough according to the present invention.

DESCRIPTION OF THE INVENTION

The present invention concerns a method and a dough for production of laminated/sheeted yeast-based bakery products from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, after which the mixed base dough is worked (kneaded), rolled and laminated/sheeted in dough layers separated by layers of fat, and eventually formed and filled with fillings. The method according to the invention is characterized in that the pre-dough is prepared from water, yeast, sugar, eventually flour and/or scrap-dough and additives and proofed, alternatively after resting in a cold store, or after thawing from a frozen condition before mixing into the base-dough, after which the ready dough is baked.

The dough according to the invention is characterized in that the pre-dough is prepared from water, yeast, eventually sugar, eventually flour and/or scrap-dough and eventually additives and fermented, alternatively after resting in a cold store, or after thawing

from a frozen condition before mixing in with the base-dough, after which the ready dough is baked.

Further characterizing features of the invention is mentioned in the description below and in the claims.

The following demands have been put on the new production process and the end product:

- That the product is of a confectioner quality, that is that there is no significant difference between the hand-made end product created by the artisan and the end product manufactured by the new process.
- That the end product not only is of a high quality, but even of an even quality resulting in an even baking result.
- That the same raw materials used in the handmade process is used in the new production process and that no chemicals and/or costly raw materials should replace and/or supplement the standard ingredients.
- That the product can be manufactured with existing equipment or standard equipment currently available on the market.
- That the product can be baked directly with standard baking equipment from the cooled or frozen condition without any defrosting and/or proofing process.
- That the different demands on quality, texture and contents set on the same product in different countries or areas can be satisfied with one and the same process.

The new process adheres to the above demands by the existing raw materials in the base dough is used and manipulated in a special way in order to obtain a pre-dough and a base-dough. The existing lamination/sheeting process is changed and/or manipulated in order to obtain an end product which satisfies the demands set by industry in the various countries or areas, and the existing baking process is changed to suit the products characterisitics and according to the specifications set by the end user.

The new production process consists of the

following stages:

1. Preparation of a pre-dough with yeast.
2. Mixing of the pre-dough with the ingredients of the base dough.
3. Laminating/sheeting process.
4. Shaping and filling of the end product.
5. Baking or cooling or freezing of the end product.
6. Storage of the end product in case of freezing under stage 5.
7. Baking of the frozen product.

1. PREPARATION OF PRE-DOUGH WITH YEAST

The preparation of the pre-dough with yeast effects the following aspects:

- Taste.
- Liquid contents in the base dough.
- The apperance of the end product which means that the pre-dough can be changed in order to obtain a product which resembles the handmade product as closely as possible.

The process used for the manufacturing of the pre-dough is determined by the hourly production required and the facilities available. The larger the production plant the more pre-dough is required per hour. To manufacture the pre-dough the ingredients are mixed and allowed to ferment for a certain period.

20 minutes fermentation
75 % water
7 % powder yeast
18 % sugar
Temperature: 40 - 45 ^{o}C

Ordinary compressed yeast may also be used, but powder yeast tolerates a higher temperature and thus can be activated quicker. To the above mixture scrap dough can be added to reach a fat contents in the base dough of not more than 5 %.

2 hours fermentation
50 % water
49 % flour
1 % sugar
20 grams compressed yeast per kilogram of flour
Dough temperature: 30 - 35 °C

For a process where the pre-dough is manufactured the day before and stored in a cooler, the following recipe is used:
50 % water
48,5 % flour
1,5 % sugar
5 grams compressed yeast per kilogram of flour
Dough temperature 8 °C
Fermentation time 8 - 12 hours

For the typical Scandinavian Danish pastry the following recipe is applicable:

Flour	54,50 %
Sugar	1,70 %
Egg powder	3,40 %
Salt	0,30 %
Oil	5,00 %
Water	33,75 %
Yeast	1,35 %
Total	100,00 %

The pre-dough can even be frozen in blocks for usage later in which case the yeast and sugar contents must be increased to a percentage which depends on the period of storage time. A 10 % increase is sufficient for 90 days storage. When freezing blocks, the dough temperature must be kept as cold a possible and the quicker methods is not advisable. The quantity of pre-dough added to the base dough depends entirely on the demands set on

the end product with regards to taste, crispiness, general appearance and storage time. The amount varies between 15 % and 50 % in relation to the base dough.

Due to the fact that pastries of the same kind not only in different countries but also in different areas of one and the same country have different characteristics in general appearance and texture, the composition of raw materials can with very slight alterations result in a totally different appearance which suit that particular area. The composition of raw materials in the pre-dough has the same effect on the end product as the raw material composition in the base dough discussed under 2.

Salt is only added to the pre-dough where a high grade of oxidation is required for example in small products. Fat in the pre-dough can be reduced, replaced by a mixture of oil and lecithin or water and lecithin or omitted totally even from the pre-dough, depending which dough structure is required. The size of the product steers this factor directly: the larger the product the less fat in the pre-dough. Powder yeast is used if a process for making the pre-dough is requiring results where time is a limiting factor as powder yeast tolerates a higher temperature. Otherwise compressed yeast is suitable. The amount of yeast is indirectly controlled by several factors: the weaker the flour is, e.g. with a low protein content, the more yeast is to be used. Less yeast may be used during lower production temperatures as the fermentation process can be stopped or slowed down with low temperatures.

The best pre-dough is obtained where pre-dough is made on a continuous basis, much the same as sour dough is made. Tests have shown that new yeast cultures will be created that are more resistant to the drying out process if the same culture is allowed to continue. It is also important to remember that the pre-dough is added for giving taste etc. and that this process must not

interfere with the base dough, otherwise the shelf life will be shortened. The pre-dough must be of such a low temperature when added to the base dough that it does not activate the yeast in the base dough. Temperature control is important to obtain the correct acid development.

2. MIXING OF THE PRE-DOUGH WITH THE INGREDIENTS OF THE BASE DOUGH

The different qualities and characteristics of the end product determines the configuration of the different raw materials in the base dough. Such raw materials are fat, vegetable or animal or combination on the two with a liquid or solid substance. An improved baking result is obtained with a fat containing 1 % lecithin. With large products such as the croissant, the fat is eliminated or decreased in the base dough and added during lamination/sheeting instead. Liquid fat can be replaced with water plus 1 - 2 % lecithin to obtain a baking result which is greater in volume.

Egg effects the crispiness and colour of the baked product. There is no difference between using fresh eggs or powder eggs. However, only newly broken eggs can be used as the pH-value changes rapidly after breaking of the eggs, resulting in shrinkages during production. As alternative to egg powder milk powder may be use together with lecithin. For larger products no eggs are used to prevent the product from darkening too fast during the baking process which in turn means that the product has not been baked thoroughly before the outside seems finished baked. Eggs can also be replaced 100 % by a mixture of water, oil and lecithin or water and lecithin or oil and 1 - 2 % lecithin, depending on what type of end result is demanded. Lecithin is difficult to mix with water and has to be mixed at high speed in advance.

Either powder yeast or compressed yeast can be used. If a very strong development in taste is required, the percentage of yeast must be increased by 10 - 15 %. Where longer storage periods are required the yeast

contents must be increased by 20 - 30 %. The yeast is very sensitive once activated by sugar and the activation of yeast in the base dough must be minimised if the end product is to be frozen.

A flour with a relative high protein content with an even quality is needed. The best results with minimum shrinkage are obtained with a strong flour, e.g. a flour with a high protein content, that has a protein content of 11,0 - 12,5 % (15 % water content). In the event of a long storage a fine texture is one of the demands which can be obtained with a strong flour. As a part of the glutenthreads are destroyed during the freezing process, extra gluten must be added when a weak flour, e.g. a flour with a low protein content, is used.

Sugar is responsible both for the taste and speed of the production process. A good result is obtained with a normal trade sugar, but a definite improvement is obtained when dextrose is used to replace the sugar or alternatively if a part of the sugar contents is replaced with an enzymatic malt. It is also beneficial to add the sugar after half the mixing time has elapsed in order to prevent the yeast cells from being activated.

Milkpowder has not significant influence on the final baking result other than a cosmetic effect. Yeast contains no ensymes that break down the lactose and it is often only the emulsifier in the milkpowder that actually improves the baking effect. When using a weak flour, the ascorbic acid levels can be doubled to give a better baking result.

Water has the same effect as yeast as it vaporises during the baking process. An 5 % increase in the water contents by for example replacing the fat in the base dough with water will give a bigger percentage volume increase. Temperatures can be lowered by adding a mixture of water and shredded ice.

It should be to observe that the pre-dough must always be added to the raw materials of the base dough

and then mixed to reduce mixing times. The base dough must be as cold as possible to prevent any form of further fermentation from starting. The yeast when subjected to freezing will dehydrate to a certain extent. The moist contents decreases in the liquid surrounding the yeast cells when the water crystals become ice crystals and even mixing times are to be kept to the absolute minimum in order to prevent heat development.

A significant variation in the baking result can be obtained with different mixing times. A slow mixing time at the end of the mixing period is of greater significance when using a low protein flour (10,5 %) than when using a high protein flour (12,5 %). A total mixing time of 6 minutes on a normal spiral mixer is optimal. For mixing a very flaky or crispy dough, the mixing time is reduced to 4 minutes. When using a dough extruder during industrial production, mixing times can be reduced by 10 - 20 % depending on what type of extruder is used as a part of the mixing process occurs in the extruder. This depends also very much on whether a constant dough supply is fed to the extruder. There is no significant difference between a 2, 3 or 5 roll extruder.

The dough temperature must be kept as low as possible with the help of cold water and raw materials and even with ice. A constant production temperature of 8 °C prevents the proofing process from commencing and the storage time being decreased. A low dough temperature even reduces the resting times between lamination/sheeting significantly.

Standard recipe for base doughs

	Danish pastry	Croissant pastry	Birke pastry
Water	33,00 %	33,00 %	33,00 %
Yeast	3,00 %	3,00 %	3,00 %
Sugar	4,60 %	3.00 %	3,00 %
Salt	0,40 %	0,40 %	0,40 %
Egg powder	3,00 %	0,00 %	0,00 %
Flour	57,00 %	58,00 %	58,00 %
Oil	2,00 %	2,60 %	2,60 %
Total	100,00 %	100,00 %	100,00 %
Pre-dough	20,00 %	25,00 %	20,00 %
Fat (laminated)	35 - 50 %	25 - 30 %	25 - 30 %

3. LAMINATING/SHEETING PROCESS

Both animal fat (butter) or vegetable fat or a mixture of both can be used in the lamination/sheeting process at temperatures recommended by the manufacturer. A high percentage of solid fats gives a better baking result as it has a better emulsion stability, but the taste will be effected negatively if the melting point is too high. Heavier products with a large circumferance complicates the baking products and it is better to remove the fat from the base dough and add this to the lamination process. Fats with a higher water contents than 20 % if available is of advantage.

The amount of layers is determined by the characteristics of the end product. An increase of 20 - 30 % in the amount of layers is demanded in the production process. The higher the total fat percentage in the product the more layers are required. The finer the texture, the more layers are demanded with a high fat content product and vica versa. The amount of layers is naturally also effected by the raw material quality, e.g. the strength of the flour used. For a Danish pastry of the Scandinavian type which has a large fat contents the

amount of layers are increased from 27 to 36. For a French croissant with a lower fat contents than Danish pastry the amount of layers are increased from 16 to 24 layers.

4. SHAPING AND FILLING OF THE END PRODUCT

There is no change in the shaping and filling process, thicknesses etc. when using the new method to that of the traditional method. With heavy products it is advantageous, though, to increase the size by 10 % and thus one is able to reduce the thickness which improves baking times.

5. BAKING OR COOLING OR FREEZING OF THE END PRODUCT

Directly after shaping and filling the product to its final form one fo the following three processes can follow:

-The product can be baked directly at a developing temperature which is 20 % lower than normal and a baking time which is 15 - 20 % longer than normal.

-The product can be cooled down to 4,0 °C and stored at this temperature for a period of up to 24 hours and baked in the same way as in the first one.

-The product can be frozen for baking at a later stage. Because of a high water and fat contents the ice crystals in the yeast cells will "explode" if the freezing is too fast or at too low temperature. This damages the gluten contents which results in a deteriorated baking result. For industrial freezing the minimum freezing temperature is -28 °C.

6. STORAGE OF THE END PRODUCT IN CASE OF FREEZING UNDER STAGE 5

The frozen product, packed in airtight bags to prevent drying out and kept at a stable temperature between -18 °C and -22 °C can be stored for a period of 9 months. Large variations in storage temperatures result in the product being dehydrated and results in a deterioration of the baking quality.

7. BAKING OF THE FROZEN PRODUCT

It is extremely difficult to specify oven temperatures and/or baking times as research has shown that ovens differ not only from the one manufacturer type to the other, but even within the same manufacturer. To reach a nucleus temperature of 96 °C (the temperature when dough products are baked) without the frozen product being too dark in colour, the following rules are applicable:

-During the beginning of the baking process a very short dosage of vapour can be given when the product does not have a fat contents which is too high e.g. Scandinavian Danish pastry. This must be done while the extractor opening is in the open position in order to prevent the dough from becoming soggy afterwards.

-The larger the product is the larger the decrease in oven temperature and the higher the increase in baking times will be. A reduction by 20 - 30 % in baking temperature and a pro-rata increase in baking time can be expected.

CLAIMS

1. The present invention concerns a method for production of laminated/sheeted yeast-based bakery products, e.g. Danish pastries, from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, after which the mixed base dough is worked (kneaded), rolled and laminated/sheeted in dough layers separated by layers of fat, and eventually formed and filled with fillings, c h a r a c t e r i z e d in that the pre-dough is prepared from water, yeast, sugar, eventually flour and/or scrap-dough and eventually additives and fermented, alternatively after resting in a cold store, or after thawing from a frozen condition before mixing into the base-dough, after which the ready dough is baked.

2. A method according to claim 1, c h a r a c t e r i z e d in that the base-dough is worked (kneaded) in 3 to 20 minutes, preferably in 3 to 6 minutes, and that the pre-dough and/or the base-dough is produced from cold raw materials and water with a temperature of 0 to 8 ^{o}C, preferably 2 to 6 ^{o}C.

3. A method according to any of the claims 1-2, c h a r a c t e r i z e d in that the layers are increased in a high fat content product from normally 24 layers up to maximum 36 layers, that the layers are reduced in a low fat content product from normally 24 layers down to minimum 16 layers in order to obtain a product which resembles a hand-made confectionery product.

4. A method according to any of the claims 1-3, c h a r a c t e r i z e d in that the mixed and worked dough is baked directly after the forming or after storing in a cold store at a temperature of 4 to 8 ^{o}C in maximum 24 hours or after storing in a frozen condition at a temperature of -15 to -20 ^{o}C, preferably -18 ^{o}C in maximum 12 months at a baking temperature which is about 20 % lower than a normal baking temperature,

preferably 10 to 30 minutes, and for about 20 % longer time, preferably 15 to 20 minutes.

5. A dough for production of laminated/sheeted yeast-based bakery products, e.g. Danish pastries, from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, c h a r a c t e r i z e d in that the pre-dough contains water, yeast, eventually sugar, eventually flour and/or scrap-dough and eventually additives.

6. A dough according to cclaim 5, c h a r a c t e r i z e d in that the pre-dough contains 40 to 80 %, preferably 75 % (by weight) water, 4 to 9 %, preferably 7 % (by weight) powder yeast and sugar and eventually scrap-dough and is designed for fermentation in 10 to 30 minutes, preferably 20 minutes, and at a dough temperature of 34 to 55 °C, preferably 40 to 50 °C.

7. A dough according to claim 5, c h a r a c t e r i z e d in that the pre-dough contains 35 to 60 %, preferably 50 % (by weight) water, 40 to 60 %, preferably 50 % (by weight) flour and 15 to 50 gram, preferably 20 gram yeast per kilogram flour and is designed for fermentation in 0,5 to 4 hours, preferably 2 hours at a dough temperature of 20 to 35 °C, preferably 25 to 30 °C.

8. A dough according to claim 5, c h a r a c t e r i z e d in that the pre-dough ccontains 35 to 60 %, preferably 50 % (by weight) water, 40 to 60 %, preferably 50 % (by weight) flour and 15 to 50 gram, preferably 5 gram yeast per kilogram flour and is designed for storing in 8 to 12 hours at a dough temperature of 4 to 12 °C, preferably 8 to 10 °C.

9. A dough according to claim 5, designed for a production of Danish pastries, c h a r a c t e r i z e d in that the pre-dough contains the following ingredients by wheight:

-flour	40	to 60	%,	preferably	54,5 %
-sugar	0,5	" 3	%,	"	1,7 %
-egg powder	0	" 5	%,	"	3,4 %
-salt	0	" 1	%,	"	0,3 %
-oil	0	" 5	%,	"	5,0 %
-water	40	" 60	%,	"	33,7 %
-yeast	1	" 3	%,	"	1,4 %

10. Laminated/sheeted yeast-based bakery products, e.g. Danish pastries, produced from a base dough ready to bake, at which a pre-dough is prepared and mixed into the base dough, at which the base dough contains water, yeast, flour and additives, e.g. sugar, salt, fat or oil, after which the mixed base dough is worked (kneaded), rolled and laminated/sheeted in dough layers separated by layers of fat, formed into dough pieces and filled with fillings, c h a r a c t e r i z e d in that the pre-dough is prepared from water, yeast, sugar, eventually flour and/or scrap-dough and eventually additives and fermented, alternatively after resting in a cold store, or after thawing from a frozen condition before mixing into the base-dough, that the dough pieces eventually is stored, preferably in a cold store or in a frozen condition, after which the dough pieces are baked.

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 92/00658

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 21 D 8/02

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 21 D

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
A	DE, B2, 1642566 (RITZER, U.) 30 March 1972, see column 2, line 50 - line 53; claim 1 --	1-10
A	US, A, 3429712 (TURNER, J.E.) 25 February 1969, see claim 1 --	1-10
A	EP, A1, 0384539 (ALBRO BAKKERIJEN B.V.) 29 August 1990, see claim 1 --	1-10

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* Special categories of cited documents:[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
14th December 1992	12 -01- 1993
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Inga-Karin Petersson Inga-Karin Petersson

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 92/00658

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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